1. **Greim, H., D. Saltmiras, V. Mostert, and C. Strupp. 2015. Evaluation of carcinogenic potential of the herbicide glyphosate, drawing on tumor incidence data from fourteen chronic/carcinogenicity rodent studies. *Crit.* Rev. Toxicol. In press**

Summary: A new scientific publication examining 14 separate cancer studies in rats and mice conducted over the last several decades concludes that there is no evidence that glyphosate, the active ingredient in Roundup branded herbicides, causes cancer. The article,in Critical Reviews in Toxicology, evaluated the data from these long term studies to determine whether there were any patterns to suggest humans exposed to glyphosate would have any concern about developing cancer. Other scientifically relevant information such as expert regulator evaluations, human dietary exposures and epidemiological studies were also discussed. The clear and consistent view across over 30 years of relevant information continues to support the first expert opinions from the 1980's, that glyphosate does not cause cancer.

Abstract: Glyphosate, an herbicidal derivative of the amino acid glycine, was introduced to agriculture in the 1970s. Glyphosate targets and blocks a plant metabolic pathway not found in animals, the shikimate pathway, required for the synthesis of aromatic amino acids in plants. After almost forty years of commercial use, and multiple regulatory approvals including toxicology evaluations, literature reviews, and numerous human health risk assessments, the clear and consistent conclusions are that glyphosate is of low toxicological concern, and no concerns exist with respect to glyphosate use and cancer in humans. This manuscript discusses the basis for these conclusions. Most toxicological studies informing regulatory evaluations are of commercial interest and are proprietary in nature. Given the widespread attention to this molecule, the authors gained access to carcinogenicity data submitted to regulatory agencies and present overviews of each study, followed by a weight of evidence evaluation of tumor incidence data. Fourteen carcinogenicity studies (nine rat and five mouse) are evaluated for their individual reliability, and select neoplasms are identified for further evaluation across the data base. The original tumor incidence data from study reports are presented in the online data supplement. There was no evidence of a carcinogenic effect related to glyphosate treatment. The lack of a plausible mechanism, along with published epidemiology studies, which fail to demonstrate clear, statistically significant, unbiased and non-confounded associations between glyphosate and cancer of any single etiology, and a compelling weight of evidence, support the conclusion that glyphosate does not present concern with respect to carcinogenic potential in humans.

2. **EPA**

2009 EPA Glyphosate Reg Review
Carcinogenicity was not identified as a concern in the work plan
http://www.epa.gov/oppsrrd1/registration_review/glyphosate/

2013 Federal Register Notice (FR 25396 Vol. 78, No. 84, Wednesday, May 1, 2013) Final Rule new tolerances in or on multiple commodities: "EPA has concluded that glyphosate does not pose a cancer risk to humans."
http://www.gpo.gov/fdsys/pkg/FR-2013-05-01/pdf/2013-10316.pdf

3. **Sorahan, T. (2015). Multiple Myeloma and Glyphosate Use: A Re-Analysis of US Agricultural Health Study (AHS) Data. *Int. J. Environ. Res. Public Health***
http://www.ncbi.nlm.nih.gov/pubmed/25635915

Summary: A new look at data from the US Agricultural Health Study (AHS) clarifies that there is no relationship between glyphosate use and the risk of multiple myeloma, a type of cancer. The study considered data collected from over 57,000 pesticide applicators to determine whether a relationship exists between multiple myeloma and glyphosate exposure. These results contradict the outcome of a previous analysis of AHS data that relied on a restricted data set to reach a different conclusion. This reanalysis of the full AHS data set for multiple myeloma is consistent with other epidemiological and laboratory research that demonstrated glyphosate does not cause cancer.

Abstract: A previous publication of 57,311 pesticide applicators enrolled in the US Agricultural Health Study (AHS) produced disparate findings in relation to multiple myeloma risks in the period 1993-2001 and ever-use of glyphosate (32 cases of multiple myeloma in the full dataset of 54,315 applicators without adjustment for other variables: rate ratio (RR) 1.1, 95% confidence interval (CI) 0.5 to 2.4; 22 cases of multiple myeloma in restricted dataset of 40,719 applicators with adjustment for other variables: RR 2.6, 95% CI 0.7 to 9.4). It seemed important to determine which result should be preferred. RRs for exposed and non-exposed subjects were calculated using Poisson regression; subjects with missing data were not excluded from the main analyses. Using the full dataset adjusted for age and gender the analysis produced a RR of 1.12 (95% CI 0.50 to 2.49) for ever-use of glyphosate. Additional adjustment for lifestyle factors and use of ten other pesticides had little effect (RR 1.24, 95% CI 0.52 to 2.94). There were no statistically significant trends for multiple myeloma risks in relation to reported cumulative days (or intensity weighted days) of glyphosate use. The doubling of risk reported previously arose from the use of an unrepresentative restricted dataset and analyses of the full dataset provides no convincing evidence in the AHS for a link between multiple myeloma risk and glyphosate use.

4. **Kier, L. D. (2015). Review of Genotoxicity Biomonitoring Studies of Glyphosate-Based Formulations. Crit. Rev. Toxicol., in press**

Summary: A recent review examined several studies that allege damage to the DNA in cells collected from people after self-reported exposures to glyphosate-based herbicides. The author concluded that there are no direct risks to human DNA under normal exposure conditions. These findings are consistent with an earlier review of an extensive number of laboratory studies that also demonstrated no direct effect on DNA. Taken together, these results confirm previous conclusions that glyphosate-based herbicides do not damage DNA in humans following real world exposures.

Abstract: Human and environmental genotoxicity biomonitoring studies involving exposure to glyphosate-based formulations (GBFs) were reviewed to complement an earlier review of experimental genotoxicity studies of glyphosate and GBF's (Kier and Kirkland, 2013). The environmental and many of the human biomonitoring studies were not informative because there was either a very low frequency of GBF exposure or exposure to a large number of pesticides. One human biomonitoring study indicated no statistically significant correlation between frequency of GBF exposure reported for the last spraying season and oxidative DNA

damage. Negative results for the lymphocyte cytokinesis-block micronucleus (CBMN) endpoint were observed in a second human monitoring study with exposure to several pesticides including GBF. There were three studies of human populations exposed to GBF aerial spraying. One study found increases for the CBMN endpoint but these increases did not correlate with self-reported spray exposure or application rates. A second study found increases for the blood cell comet endpoint at high exposures causing toxicity. However, a follow-up to this study two years after spraying did not indicate chromosomal effects. The results of the biomonitoring studies do not contradict an earlier conclusion derived from experimental genotoxicity studies that typical GBF's do not appear to present significant genotoxic risk under normal conditions of human or environmental exposures.

5. **Kier, LD and DJ. Kirkland. 2013. Review of genotoxicity studies of glyphosate and glyphosate-based formulations. Critical Reviews in Toxicology. 43:283.**
http://www.ncbi.nlm.nih.gov/pubmed/23480780

Summary: A review of an extensive number of laboratory studies examining the potential for glyphosate and glyphosate-based herbicides to damage DNA concludes that these products do not damage DNA under normal exposure conditions. This review includes peer-reviewed publications and regulatory studies. The evaluation of the large amount of data available confirms that glyphosate is not genotoxic to humans and that glyphosate and glyphosate-based products do not damage DNA under normal exposures.

Abstract: An earlier review of the toxicity of glyphosate and the original Roundup™-branded formulation concluded that neither glyphosate nor the formulation poses a risk for the production of heritable/somatic mutations in humans. The present review of subsequent genotoxicity publications and regulatory studies of glyphosate and glyphosate-based formulations (GBFs) incorporates all of the findings into a weight of evidence for genotoxicity. An overwhelming preponderance of negative results in well-conducted bacterial reversion and in vivo mammalian micronucleus and chromosomal aberration assays indicates that glyphosate and typical GBFs are not genotoxic in these core assays. Negative results for in vitro gene mutation and a majority of negative results for chromosomal effect assays in mammalian cells add to the weight of evidence that glyphosate is not typically genotoxic for these endpoints in mammalian systems. Mixed results were observed for micronucleus assays of GBFs in non-mammalian systems. Reports of positive results for DNA damage endpoints indicate that glyphosate and GBFs tend to elicit DNA damage effects at high or toxic dose levels, but the data suggest that this is due to cytotoxicity rather than DNA interaction with GBF activity perhaps associated with the surfactants present in many GBFs. Glyphosate and typical GBFs do not appear to present significant genotoxic risk under normal conditions of human or environmental exposures.

6. **Mink, P., J. Mandel, B. Sceurman, J. Lundin. 2012. Epidemiologic studies of glyphosate and cancer: A review. Regulatory Toxicology and Pharmacology. 63:3.**
http://www.sciencedirect.com/science/article/pii/S0273230012000943

Summary: A review of 21 epidemiological studies found no causal relationship between exposure to glyphosate and cancer in adults or children. This observation is consistent with

conclusions from regulatory authorities that glyphosate is unlikely to pose a risk to human health based on previous toxicology studies.

Abstract: The United States Environmental Protection Agency and other regulatory agencies around the world have registered glyphosate as a broad-spectrum herbicide for use on multiple food and non-food use crops. Glyphosate is widely considered by regulatory authorities and scientific bodies to have no carcinogenic potential, based primarily on results of carcinogenicity studies of rats and mice. To examine potential cancer risks in humans, we reviewed the epidemiologic literature to evaluate whether exposure to glyphosate is associated causally with cancer risk in humans. We also reviewed relevant methodological and biomonitoring studies of glyphosate. Seven cohort studies and fourteen case-control studies examined the association between glyphosate and one or more cancer outcomes. Our review found no consistent pattern of positive associations indicating a causal relationship between total cancer (in adults or children) or any site-specific cancer and exposure to glyphosate. Data from biomonitoring studies underscore the importance of exposure assessment in epidemiologic studies, and indicate that studies should incorporate not only duration and frequency of pesticide use, but also type of pesticide formulation. Because generic exposure assessments likely lead to exposure misclassification, it is recommended that exposure algorithms be validated with biomonitoring data.

7. **Niemann, L., C. Sieke, R. Pfeil, R. Solecki. 2015. A critical review of glyphosate findings in human urine samples and comparison with the exposure of operators and consumers. Journal of Consumer Protection and Food Safety.**
http://rd.springer.com/article/10.1007%2Fs00003-014-0927-3

Summary: The German Federal Institute for Risk Assessment reviewed seven existing biomonitoring studies where trace amounts of glyphosate were found in human urine samples. The authors concluded that at thelevels of glyphosate found, there is no concern for human health. After oral intake glyphosate is not metabolized significantly by humans and is rapidly excreted in urine. By measuring urine levels it is possible to calculate internal exposure levels. They concluded that realistic exposures are low and are well below the worst-case assumptions used by regulatory agencies.

Abstract: For active substances in plant protection products (PPP) with well defined urinary elimination, no potential for accumulation and virtually no metabolism, measuring of urine levels could be a powerful tool for human biomonitoring. Such data may provide reliable estimates of actual internal human exposure that can be compared to appropriate reference values, such as the ‘acceptable daily intake (ADI)’ or the ‘acceptable operator exposure level (AOEL)’. Traces of the active compound glyphosate were found in human urine samples, probably resulting either from occupational use for plant protection purposes or from dietary intake of residues. A critical review and comparison of data obtained in a total of seven studies from Europe and the US was performed. The conclusion can be drawn that no health concern was revealed because the resulting exposure estimates were by magnitudes lower than the ADI or the AOEL. The expected internal exposure was clearly below the worst-case predictions made in the evaluation of glyphosate as performed for the renewal of its approval within the European Union. However, differences in the extent of exposure with regard to the

predominant occupational and dietary exposure routes and between Europe and North America became apparent.